

Claims

1. A handler for singulating at least one packaged substrate into a plurality of packaged semiconductor devices, the handler comprising:
 - 5 a first movable mount for moving between a loading location and a cutting location, the first movable mount adapted to receive the at least one packaged substrate at the loading location, the first movable mount for transporting the at least one packaged substrate from the loading location to the cutting location, and the first movable mount
10 adapted to secure the at least one packaged substrate thereon while the at least one packaged substrate is at least partially cut at the cutting location; and
 - a second movable mount for moving between the cutting location and an unloading location, the second movable mount adapted to
15 receive the at least one packaged substrate that is at least partially cut at the cutting location, the second movable mount for securing the at least one packaged substrate thereon while the at least one packaged substrate is at least partially cut at the cutting location to produce at least some of the plurality of packaged semiconductor devices, and the
20 second movable mount for transporting the at least some of the plurality of packaged semiconductor devices from the cutting location to the unloading location.
2. A handler in accordance with claim 1, further comprising at least
25 one cutting tool disposed at the cutting location, the at least one cutting tool suitably adapted for cutting the at least one packaged substrate.
3. A handler in accordance with claim 2, wherein the at least one
cutting tool comprises at least one water jet from at least one water jet
30 nozzle.

4. A handler in accordance with claim 3, wherein the at least one water jet includes abrasive material.
5. A handler in accordance with claim 4, further comprising a distance detector mounted proximal the at least one water jet nozzle, the distance detector for detecting the distance between the at least one water jet nozzle and the at least one packaged substrate when cutting the at least one packaged substrate with the at least one water jet, and the distance detector for providing a detected distance.
- 10 6. A handler in accordance with claim 7 further comprising a movable mount for mounting the water jet thereto, the movable mount being coupled to receive an adjusted distance, the movable mount for maintaining a predetermined distance between the water jet and the at least one packaged substrate when cutting the at least one packaged substrate with the water jet, in accordance with the adjusted distance.
- 20 7. A handler in accordance with claim 1 further comprising at least one transport guide that extends from the loading location, through the cutting location, and to the unloading section, wherein at least the first movable mount is movably coupled to the at least one transport guide.
- 25 8. A handler in accordance with claim 7 wherein the at least one transport guide comprises at least a pair of rails, and wherein at least the first movable mount is movably coupled to the pair of rails.
9. A handler in accordance with claim 8 wherein at least the second movable mount is movably coupled to the pair of rails.
- 30 10. A handler in accordance with claim 9 wherein the pair of rails are substantially linear and extend substantially parallel to each other from

the loading location, through the cutting location, and to the unloading location.

11. A handler in accordance with claim 1 wherein the first movable
5 mount comprises a rotatable vacuum chuck for securing the at least one packaged substrate thereto.

12. A handler in accordance with claim 11 wherein the second
movable mount comprises a rotatable vacuum chuck for securing the at
10 least one packaged substrate thereto.

13. A handler in accordance with claim 1, further comprising a
movably mounted image capture device directed at the loading location
for capturing at least one image of the at least one packaged substrate
15 on the first movable mount, when the first movable mount is at the loading location.

14. A handler in accordance with claim 1, further comprising a
second image capture device directed at the cutting location for
20 capturing at least one image of the at least one packaged substrate on the second movable mount, when the second movable mount is at the cutting location.

15. A handler in accordance with claim 1, further comprising a
25 transfer means for transferring the at least one packaged substrate from the first moveable mount to the second movable mount.

16. A handler in accordance with claim 1, wherein the transfer means
comprises at least one pick and place assembly mounted to operate at
30 the cutting location.

17. A method for handling at least one packaged substrate for singulation into a plurality of packaged semiconductor devices, the method comprising:

a) providing:

5 a first movable mount for moving between a loading location and a cutting location; and

a second movable mount for moving between the cutting location and an unloading location,

b) moving the first movable mount from the loading location to the cutting location with the at least one packaged substrate disposed thereon;

c) cutting the at least one packaged substrate in a first reference direction at the cutting location;

d) transferring the at least one packaged substrate from the first movable mount to the second movable mount;

e) cutting the at least one packaged substrate in a second reference direction, different from the first reference direction, at the cutting location, to produce the plurality of packaged semiconductor devices; and

20 f) moving the second movable mount from the cutting location to the unloading location.

18. A method in accordance with claim 17 further comprising, prior to (b), loading the at least one packaged substrate on the first movable mount.

19. A method in accordance with claim 17 further comprising, after (f), unloading the plurality of packaged semiconductor devices on the second movable mount.

20. A method in accordance with claim 17, wherein step (a) further comprises providing a water jet for cutting the at least one packaged substrate in (c).
- 5 21. A method in accordance with claim 17, wherein (a) further comprises providing a water jet for cutting the at least one packaged substrate in (e).
22. A method in accordance with claim 17 further comprising, after
10 (b) but before (c), aligning the at least one packaged substrate with the water jet.
23. A method in accordance with claim 17 further comprising, after
15 (d) but before (e), aligning the at least one packaged substrate with the water jet.
24. A method in accordance with claim 17 wherein (b) further comprises moving the second movable mount from the cutting location to the unloading location with at least another previously singulated
20 packaged substrate disposed thereon.
25. A method in accordance with claim 24 wherein (c) further comprises unloading the at least another previously singulated packaged substrate at the unloading location.
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26. A method in accordance with claim 20 wherein (c) further comprises moving the first movable mount in the first reference direction.
- 30 27. A method in accordance with claim 20 wherein (c) further comprises moving the water jet in the second reference direction.

28. A method in accordance with claim 21 wherein (e) further comprises moving the second movable mount in the first reference direction.

5 29. A method in accordance with claim 21 wherein (e) further comprises moving the water jet in the second reference direction.

30. A method in accordance with claim 17, wherein (d) comprises
picking the at least one packaged substrate off the first movable mount,
10 moving the first movable mount from the cutting location to the loading
location, moving the second movable mount from the unloading location
to the cutting location, and placing the at least one packaged substrate
on the second movable mount.